# Chapter 13
# Applying the Safety and Environmental Risk and Reliability Model (SERM) for Malaysian Langat River Collision Aversion

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## ABSTRACT

*Collision accident remains a big threat to coastal water transportation operation. Occurrence of a collision event exposes vessel owners and operators as well as the public to risk. The nature of the threat can be worrisome; it may lead to loss of life, damage to the environment, disruption of operation, and injuries. This makes hybrid analysis of accident frequency and consequence for risk quantification of accident scenarios through stochastic tools very imperative for reliable design and exercise of technocrat stewardship of safety and safeguard of the environmental. The study involves a predictive model for collision risk and mitigation option for aversion of collision incident. Accident frequency and consequence are obtained using probability tools. Validity of the result is checked with reliability tools. Findings of the study were checked with subsystem and uncertainty risk-contributing factors in order to arrive at a sustainable decision support for collision aversion for inland water transportation. This chapter discusses the result and validation of implementation of the Safety and Environmental Risk and Reliability Model (SERM) for aversion of collision accident for vessel navigating for inland waterways.*

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## INTRODUCTION

Vessel collision risks in waterways are of huge consequence. Collision accident scenarios carry heavy consequence, thus their occurrence is infrequent. These accidents represent a risk because they expose vessel owners and operators, as well as the public, to the possibility of losses such as vessel and cargo damage, injuries and loss of life, environmental damage, and obstruction of waterways. They can also lead to instantaneous and point form release of harmful substances to water, air, soil and long time ecological impact (Nikolaidis, 2005). Environmental problems and the need for system reliability calls for innovative methods and tools to assess and analyse extreme operational, accidental and catastrophic scenarios as well as accounting for the human element, and integrate these into a design environments part of design objectives. Risk and reliability—based design entails the systematic integration of risk analysis in the design process targeting system risk prevention, reduction that meet high—level goals and leave allowance for integrated components of the system includes environmental conditions that will facilitate and support a holistic approach for reliable and sustainable waterways and require trade-offs and advance decision-making leading to optimal design solutions (Blischke, 2000).

Collision risk is a product of the probability of occurrence of the physical event and consequential losses. Earlier risk–modeling focused more on either frequency estimation or consequence and leave analysis with remnant uncertainties. Paralleled analysis of frequency and consequence analysis along with translation of other consequence (economic, oil spill, GHG) could lead to quantification of total collision risk. Collision data may be imperfect or inconstant, making it difficult to account for dynamic issues associated with vessels and waterway requirements. Accounting for these lapses necessitated a need to base collision analysis on hybrid use of deterministic, probabilistic or simulation methods depending on the availability of data. Collision accident consequence data are hard to come by, like accident frequency data. However, whatever data that is available should be meaningfully processed as much as possible through available tools especially predictive methods for necessary mitigation decision support for sustainable waterways system design.

Developing sustainable Inland-Water Transportation (IWT) requires transit risk analyses of waterways components and relationship between factors such as environmental conditions, vessel characteristics, operators' information about the waterway, as well as the incidence of groundings and collisions, using available data. Whatever information is available is useful for risk and reliability- based decision work of accidents rate of occurrence, consequence and mitigation (Eftratios Nikolaidis, 2005; McGee et al., 1999). The analysis considers mainly the waterways dimensions and other related variables of risk factors like operator skill, vessel characteristics, traffic characteristics, topographic, environmental difficulty of the transit, and quality of operator's information in transit which are required for decision support related to efficient, reliable and sustainable waterways developments.

This chapter discusses modeling of waterways collision risk. The paper presents the model of waterways collision risk and associated rate of occurrence and consequence. Relation with other variable risk factors like operator skill, vessel characteristics, traffic characteristics, topographic and environmental difficulty of the transit are taken into consideration (Wallace, 2000; John, 2000). Accident frequency and consequence are determined stochastically. Waterway variable and parameters are compared. The result hopes to contribute to decision support for development and regulation of inland water transportation. Also discussed is deduced generic risk mitigation option required for operational, societal, limit definition and technological change decision support for development of sustainable Inland-Water